

**REMARKS**

The Office Action of October 5, 2007, and the references cited therein have been carefully considered.

Although Applicants are of the opinion that the claims as presented in the last Amendment are allowable over the prior art of record without further amendment, in order to advance the prosecution of this application, each of independent claims 1, 9, and 18 has been amended to positively recite that the punching part is cylindrical, i.e., has a constant diameter, and claims 10 and 19, which are dependent on claims 9 and 18, respectively, and contained this limitation, have been amended so that they are consistent with claims 9 and 18 as now amended.

The rejection of claims 9-12 and 16-20 under 35 U.S.C. §103(a) as being unpatentable over EP published patent application to Dietz in view of the U.S. published patent application of Takashima has been noted and is respectfully traversed.

The present invention as recited in the claims is directed to a device for punching holes in unfired ceramic substrates, so called green sheets for use particularly for electronic circuit boards. It is well known that circuit boards for electronic circuits are made of ceramic which then are provided with conductors on one or both sides as well as electronic devices. In order to connect conductors on one side of the board to conductors or components on the other side, so called vias are provided. A via is formed by hole that is metallized during the production process in order to form an electrically conductive path from one side of the ceramic circuit board to the other.

It is nearly impossible to drill these holes into a fired ceramic board as precisely as desired and with high productivity. Therefore, the holes are punched into the ceramic sheet before it is fired. These unfired or "green" sheets, however, have a considerable thickness. While it is desirable for the thickness of the ceramic green sheet to be rather high in order to obtain a high degree of stiffness and rigidity, the diameter of the holes to be punched becomes smaller and smaller as a result of decreased dimensions for the conductors and components. That is, while the desired diameter of the holes used to be much larger than 0.1 millimeters, the desired diameter of the holes is currently much less. That is, diameters of 0.06 millimeters and less are to be achieved.

This created a problem in view of the design of the prior art punch. Length of the cylindrical punching portion, i.e., the portion 26 of the punch according to the present invention, has to be equal to or greater than the thickness of the green sheet. Moreover, if the working part of the punch is used to guide the punch, the length of the working part has to additionally be increased. Examples of standard designs of this type are shown, for example, in U.S. Patent Nos. 4,092,888 and 4,425,829. This type design is very good if the hole to be punched is rather large compared to the thickness of the green sheet, e.g., see FIG. 1 of U.S. 4,425,829. However, if the diameter of the hole is very much less than the thickness of the green sheet, then the ratio of the length to the diameter of the punching part will be too large, resulting in the punching part no longer being stable. This instability will cause the punching part to bend sidewardly and cause problems if pushed toward the green sheet.

The above described problem is solved according to the present invention by providing a punch having three different diameters including an unguided punching part 26 of the working portion, the guiding part 24 of the working portion, and the shaft 15. Consequently, the ratio between the length and the diameter of the punching part 26 is diminished, which results in an increased stiffness thereof. More specifically, in the punching device according to the invention as defined in claims 9 and 18, the die has a thin short punching portion (26) having a diameter essentially corresponding to the diameter of the desired hole, a thicker intermediate portion (25) with a slightly larger diameter and finally a shaft (15) having a still larger diameter that is a multiple of the diameter of the intermediate part (25). The die is mounted above a **receiving device** (22) with a **substantially flat receiving face** for the green sheet and an opening (7) for receiving the punching portion (26) during a punching operation. The die is mounted so that its shaft portion (15) is guided in a bushing (18) while the intermediate portion (25) is guided in a stripper bore or opening (24) of a stripper bushing (21). The length of the stripper opening (24) is greater than that of the punching portion (26) so that the punching portion can be withdrawn into the stripper opening (24) while a portion of the intermediate portion (25) is still in the stripper opening and guided thereby. Thus the short punching portion (26), which is not directly guided by the stripper opening (24), is within the stripper when not in use and only exits the stripper opening (24) during a punching action. Note that the only the punching portion (26) at the end of the die performs any punching action while the intermediate portion (25) provides only a guiding function for the die near the punching portion (26). Contrary to the Examiner's statements in the Office Action, **no device for simply punching**

**tapered holes or openings in a green sheet, or any other type sheet, is disclosed in Figs 1-4 of the Dietz reference.**

In rejecting the claims, the Examiner has essentially taken the position that Figs. 1-4 of the Dietz reference shows all of the claimed features except that the part 14 of Dietz is used as a guide rather than as a punch; that Takashima teaches an operative 5 for making a tapered hole having a first part 5c and a second part 5b; and that consequently it would have been obvious to one skilled in the art to incorporate the second punching part as taught by Takashima into the second part of Dietz to speed up the process of making a tapered hole since the tapered portion and the constant diameter portion are made in one step rather than two as taught by Dietz; and that such a combination would result in the invention defined in independent claims 9 and 18. It is initially submitted that one skilled in the art would not consider combining these references in the manner suggested by the Examiner since both references are directed to the solution of completely different problems in very specific areas of technology. Moreover, even if the suggested combination could in some way be made, it would result in the production of a hole with a cylindrical portion and a tapered portion whereas the punch according to the **present invention makes only a cylindrical hole** and has features either not found in or contrary to the teachings of the two cited references.

The Dietz reference is directed to a device for use with metal sheets wherein completely different problems and conditions are involved. The device of Dietz as shown in Figs 1-3, which are the figures containing the punching element with the guide portion 14, does **not punch** any holes in the metal sheet (11) or even remove any material. Rather the Dietz device of Figs. 1 and 2 wishes to convert an existing

hole or opening (16) in the metal sheet (11) to a countersunk hole (18 or 19) with a chamfered or conical edge as shown in Fig. 2 of Dietz to receive the head of a screw. Note that in the Dietz device the working part of the die of Dietz is the conical part (13) of the die, while the lower end portion (14) with the rounded nose simply serves as a centering guide for the die during the countersinking operation. Moreover, the lower end portion (14) not only serves as a general guide, but also serves as an inner abutment that limits the radially inwardly oriented flow of material, resulting in an opening 18 with a smaller diameter than original opening 16. Moreover, in order to accommodate the extra material pushed aside by the portion (13) of the punching die, the receiving surface or die (7) is provided with an upward bulge as can clearly be seen in the figures. This is contrary to the presently claimed invention wherein the receiving surface is flat. The embodiment of Fig. 3 of Dietz operates in essentially the same way as the embodiment of Figs. 1 and 2, except that it converts a round hole (16) in the metal sheet (11) to a countersunk hole (20) of smaller diameter but with a square cross-section as shown in Fig. 3. The only embodiment of Dietz that actually punches a hole in the metal Sheet (11) is that of Fig. 4, which clearly shows a die (23) with a constant diameter and converts a smaller hole (21) to a larger hole (22) as shown in Fig. 4. This actual punching embodiment does have a substantially flat receiving substrate for the metal sheet. Accordingly, for at least the above stated reasons, it is submitted that independent claims 9 and 18, and claims 10-12, 16 and 17 dependent on claim 9 and claims 19 and 20 dependent on claim 18, are allowable over the Dietz reference under 35 U.S.C. §103(a).

In addition to the above, it is noted that contrary to the statement of the Examiner, the die of Dietz does not have three parts including a shaft 2, an intermediate part (6) and a punching part (14), but rather a die including only the shank 6, the working portion 13, and the centering portion 14. The part 2 identified by the Examiner as the claimed shaft is not part of the die itself, but rather a holder for the die (see English Abstract). Accordingly, for these additional reasons, it is submitted that claims 9-12 and 16-21 are allowable over the Dietz reference under 35 U.S.C. §102(b).

In an attempt to overcome the deficiencies of the Dietz reference, the Examiner has cited the Takashima reference, which likewise relates to forming holes with a lower portion with a tapered portion at one end in stainless steel sheets for use in ink jet printers. However, this reference teaches that the operative or punch 5 should have a first portion 5a with a forward taper and a second portion 5b that tapers in the reverse direction (see paragraph 0018). Thus both portions of the operative 5 are tapered and neither part is cylindrical as required by claims 9 and 18. Note that since the reference deals with a tapered punch or operative, it is not concerned with the problem of length/diameter ratio since a tapered punch is inherently stiff due to the increasing diameter as its basis. In any case, the Takashima reference, even if combined with the Dietz reference in some manner would not result in the invention defined in claims 9 and 18 and the claims dependent thereon. Accordingly, for the above stated reasons, it is submitted that claims 9-12 and 16-20 are allowable over the combination of the Dietz and Takashima references under 35 U.S.C. §103(a).

The rejection of claims 1-3, 5-7, 14 and 15 under 35 U.S.C. §103(a) as being unpatentable over the Dietz reference in view of the references to Saito and Takashima has been noted and likewise is respectfully reversed. In this ground of rejection, the patent to Saito is cited simply to show that it is known to provide a receiving device with a plurality of punched holes. This is readily admitted although the reason for the plurality of punched holes in the receiver according to the present invention is to permit a plurality of holes to be simultaneously punched using a plurality of similar dies and not to accommodate different size punches.

Claim 1 essentially contains all of the limitations of claim 9 as discussed above, although in different terms. Accordingly, it is submitted that claim 1 and claims 2, 3 and 5-7 dependent on claim 1 and claims 14 and 15 dependent on claim 9 are allowable over the combination of the Dietz and Takashima references for essentially the same reasons as discussed above with regard to claim 9. Moreover, the patent to Saito, which was cited simply to show that it is known to provide a receiving device with a plurality of holes, but does not overcome the deficiencies of the Dietz-Takashima combination of references as discussed above. Accordingly, it is further submitted that claims 1-3, 5-7, 14 and 15 are allowable over the combination of the Dietz, Takashima and Saito references under 35 U.S.C. §103(a).

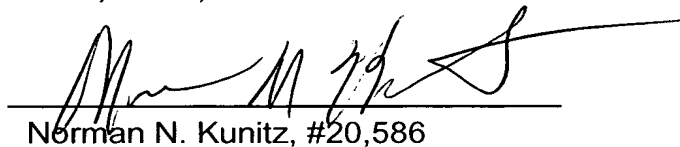
For the above-stated reasons, it is submitted that all of the pending claims, i.e., claims 1-3, 5-7, 9-12 and 14-20, are allowable over the references and rejections of record and are in condition for allowance. Therefore, the allowance of these claims and the passing of this application to issue are respectfully requested.

If the Examiner is of the opinion that the prosecution of the application would be advanced by a further personal interview, the Examiner is invited to telephone undersigned counsel to arrange for such an interview.

To the extent necessary, Applicants hereby request any required extension of time not otherwise requested and hereby authorize the Commissioner to charge any required fee not otherwise paid, including application processing, extension, and extra claims fees, to Deposit Account No. 06-1135.

Respectfully submitted,

**FITCH, EVEN, TABIN & FLANNERY**



Norman N. Kunitz, #20,586

**Customer No. 42798**  
One Lafayette Centre  
1120 - 20<sup>th</sup> Street, NW  
Suite 750, South  
Washington, DC 20036  
(202) 419-7000 (telephone)  
(202) 419-7007 (telecopier)  
NNK:rk